

AN UPDATE ON THE DEPARTMENT OF ENERGY'S PHOTOVOLTAIC PROGRAM

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Summary

Funding for the terrestrial photovoltaics program is \$78 million in 1994. This is more than double the minimum level reached in 1989 and runs counter to the general trend of decreasing budgets for Department of Energy (DOE) programs. During the past five years, the program has expanded its mission from research and development to also address manufacturing technology and commercialization assistance. These new activities are directed toward revitalizing the market to reinstate the rapid rate of sales growth needed to attract investment. The program is approaching balance among efforts in each of the three areas. This translates to a reduction in some of the R & D activities of most relevance to the space power community. On the other hand, some of the advancements in manufacturing may finally bring thin-film technologies to reality for space arrays. This talk will describe the status and direction of DOE program with an eye toward highlighting its impact on technology of interest for space.

Introduction

During the latter part of the 1980's, the growth rate in photovoltaic module shipments was more than 20%. Industry shifted from a condition of shipping from excess inventory to back-orders. During the last several years, world wide sales growth has slowed to less than 5%. This condition is attributed to the world wide recession. This condition does not help the industry attract capital needed for expansion of production or introduction of new products. The Department of Energy has addressed this problem by adding two programs focussed at helping industry to increase sales. First, the program directed support to manufacturing technology research to further improve competitiveness and open new applications by reducing product cost. The second initiative increased interactions with envisioned customers to enhance awareness of photovoltaic technology for applications where it is competitive today. The result on the total program budget can be seen in Figure 1.

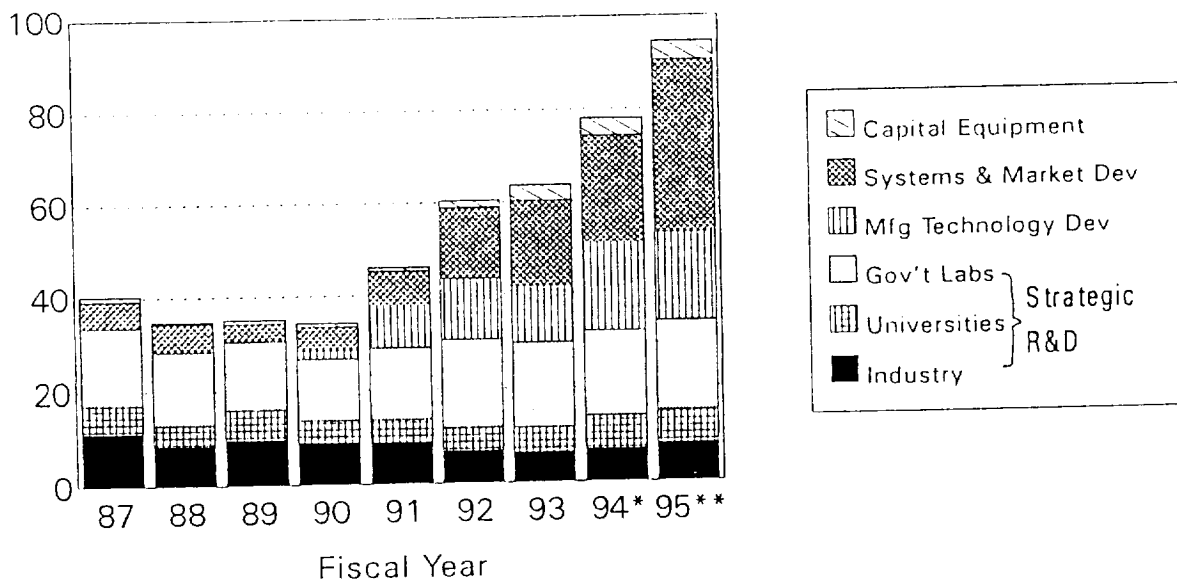


Figure 1. US DOE Photovoltaic Program Budgets

*FY94 Est. prior to rescissions

**FY95 Est. based on DOE budget request

Photovoltaic Manufacturing Technology

The Photovoltaics Manufacturing Technologies (PVMaT) project is a partnership between the U.S. Department of Energy and the U.S. PV industry. By working together to reduce costs, the partners ultimately hope to extend the U.S. leadership in manufacturing and developing commercial PV systems.

The PVMaT project is being conducted in three phases. Phase 1 identified and prioritized areas in the manufacturing processes where research and development were needed for major production cost reductions. Problem solutions began in 1992, under Phase 2A, while Phase 3A addresses generic module manufacturing needs common to the PV industry. Current industry partners, topic and award amounts are shown in Figure 2.

| Company | Topic | Principal Investigator | Amount (\$M) |
|---------------------------|-----------------------------|------------------------|--------------|
| Phase 2A | | | |
| Siemens Soar Industries | Cz Silicon | Terry Jester | 10.5 |
| Solarex Corporation | Triple Junction a-Si Alloys | Robert Oswald | 10.0 |
| ENTECH, Inc. | Linear Focus Conc. Modules | Mark O'Neill | 3.1 |
| Astropower, Inc. | Silicon Film Technology | Sandi Collins | 7.1 |
| Utility Power Group | a-Si Modules | Michael Stern | 4.7 |
| Energy Conversion Devices | Roll-to-Roll a-Si | Masatsuga Izu | 10.8 |
| Phase 2B | | | |
| Golden Photon, Inc. | CdTe | Steve Johnson | 9.8 |
| Solarex Corporation | Cast Silicon | John Wohlgemuth | 6.3 |
| Solar Cells, Inc. | CdTe | Dan Sandwisch | 7.4 |
| Texas Instruments | Spherical Silicon | Jim Skelly | 16.6 |
| Phase 3A | | | |
| Springborn Laboratories | Improved Encapsulants | Bill Holley | 1.5 |
| Spire Corporation | Automated Cell Assembly | Mike Nowlan | 1.4 |

Figure 2 PVMaT Industry Partners

Systems and Market Development

The DOE has established the PV Compact Coordinating Council as the focus of market development activities in the United States. PV Compact consists of utility representatives from the Utility Photovoltaic Groups (UPVG) and representatives from state energy offices and state Public Utility Commissions (PV4U). The DOE/NREL PV Program is supporting the development of a strategy to commercialize PV through UPVG. This is an organization of more than 70 utilities that work together to advance cost-effective and high-value uses of PV for utilities. UPVG activities include publishing a newsletter, sponsoring workshops, and supporting five active working groups working towards a goal to lead utilities into photovoltaic systems acquisitions of about 50 megawatts over five years with less than 30% government cost sharing. PV4U is a project to work with and assist state working groups involved with the development of PV systems by utilities.

Building Opportunities in the United States for Photovoltaics (PV:BONUS) is a DOE/NREL project to evaluate and implement innovative ideas for integrating PV into building systems. Twenty-nine teams proposed concepts, and, in FY 1993, five teams began work on the planned 5-year, \$25-million (from DOE) cost-shared project. Each of the five teams includes a lead contractor and up to 10 other organizations representing building-materials manufacturers, building contractors, PV suppliers, utilities, colleges and universities, systems designers, architectural and engineering firms, and building owners.

The DOE/NREL PV Program helps U.S. PV companies reach the growing international markets by leveraging funds and lowering institutional barriers to international trade in PV technology. DOE shares the cost of pilot installations, and PV Program personnel help perform site assessments, develop project evaluation criteria, write technical specifications for projects, and conduct workshops and training seminars.

In FY 1993, DOE and the Federal Republic of Brazil began working together to bring electricity to rural communities in Brazil using PV. The first phase began in December 1992 with the installation of lighting systems on 600 homes, schools, and public spaces in rural areas. Phase 2 of this project is now underway, with DOE contributing approximately \$1.3 million toward the estimated \$3 million cost of the project's second phase in FY 1994. Other project development efforts are underway in China, India, and Indonesia.

The guiding principal behind all of the market development activity is the establishment of expanded markets that are sustained by the competitiveness of photovoltaic products such that ongoing Federal support, in tax policy or direct funding, is not required.

Strategic Research and Development

The budget for photovoltaic research has been held flat during the period in which the new initiatives in manufacturing and market development were added. However, within the research program, priorities have changed substantially. The support for thin-film technologies has grown to keep pace with inflation. Other projects needed to be reduced to afford to maintain thin-films. Much of this reduction came from support of concentrator and high efficiency options. Currently, the newest element of the research program is the active request for proposals to form a Thin-Film Partnership. This single solicitation will draw in proposals from both the major industrial interests and well as the research teams from industry, universities and not-for-profit laboratories. The goals of the procurement are to: i) support the successful introduction of U.S. thin film products; and, ii) support advanced thin-film R&D needed for future product competitiveness. Since this is an active solicitation, no more can be described in this paper.

